

## EXHIBIT 1

PATENT  
Atty. Docket No. MIC35 P-321

## IN THE UNITED STATES PATENT OFFICE

Art Unit : 1711  
Examiner : Jeffrey C. Mullis  
Applicants : Petar R. Dvornic et al.  
Appln. No. : 09/888,736  
Filing Date : June 25, 2001  
Confirmation No. : 2078  
For : HYPERBRANCHED POLYMER DOMAIN NETWORKS AND  
METHODS OF MAKING SAME

Mail Stop Amendment  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, Virginia 22313-1450

Dear Sir:

DECLARATION OF PETAR R. DVORNIC

I, Petar R. Dvornic, hereby declare the following:

1. I am a coinventor of the invention disclosed and claimed in the above-identified United States patent application.
2. My curriculum vitae, which provides a partial listing of my academic and professional experiences and accomplishments is attached hereto.
3. I have authored or co-authored ten United States patents in the field of dendritic polymer technology, with others pending.
4. I respectfully submit that I am qualified to provide an expert opinion relative to the applied Hedrick et al. reference.
5. I have read the applied Hedrick et al. reference (Structure Control In Organic-Inorganic Hybrids Using Hyperbranched High-Temperature Polymers," *Macromolecules*, 1997, 30, 7607-7610).
6. The Hedrick et al. reference discloses compositions of matter in which an organic hyperbranched polymer is a dispersed phase in a polysilsesquioxane matrix.

7. The authors expressed the opinion that the abundance of end functional groups in the hyperbranched polymer can be exploited to maximize "interaction between the organic and inorganic phases."

8. The authors also state that the end groups of the hyperbranched polymers "are capable of hydrogen bonding with the poly(silsesquioxane), albeit to different degrees."

9. The authors indicate that "the nature of the chain ends of the hyperbranched macromolecules was shown to have a dramatic effect on the phase separation and morphology of the composite materials."

10. In my opinion, the above statements of Hedrick et al. clearly demonstrate that the disclosed composition of matter is not a cross-linked network, but is instead a composite material having a hyperbranched polymer dispersed throughout a polysilsesquioxane matrix. The interactions, more specifically hydrogen bonding, that are alleged or believed to occur between the silsesquioxane and the hyperbranched polymer do not constitute a chemical linkage capable of forming a covalently cross-linked network.

11. In addition, a hydrogen bond is a secondary interaction, not a primary bond, as is the case with a covalent bond.

12. It is my opinion that the use of secondary bonds to inhibit phase separation in a composite material having an organic polymer dispersed in an inorganic polymer does not suggest a cross-linked polymer network as claimed.

13. For the above reasons, it is my opinion that the claims as amended are entirely different from, and would not have been obvious, based on the teachings of Hedrick et al.

14. Examples 3, 4, 6, 9, 11, 13, 15 and 17 each disclose curing of a hyperbranched polymer having terminal groups that are not reactive with each other by cross-linking the hyperbranched polymer molecules using alpha,omega-telechelic linear polymer cross-linkers, which are only capable of reacting with the terminal groups of the hyperbranched polymers via their terminal reactive groups.

15. The expression "alpha,omega-telechelic polymer" refers to a linear polymer having reactive functional groups at its opposite ends, and not having any other reactive functional groups.

16. Thus, the reaction products of above-referenced examples must necessarily be cross-linked networks comprising hyperbranched polymer moieties that are covalently linked to each other solely by the linear polymer moieties.

17. It is my opinion and belief that the person of ordinary skill in the art to which our invention pertains would have known that the composition disclosed in each of the above-referenced examples contains a hyperbranched polymer molecule having functional groups that are not reactive with each other or with any other chemical species in the examples except for the terminal groups of the alpha,omega-telechelic linear polymer cross-linkers.

18. Further, it is my opinion and belief that the person of ordinary skill in the art to which our invention pertains would have known that upon curing, the resulting cross-linked polymer networks must be comprised of hyperbranched polymer moieties that are linked to each other solely by linear polymer moieties covalently bonded to the hyperbranched polymer moieties at the terminals of the linear polymer moieties.

19. I declare that all statements made herein of my own knowledge are true and all statements made on information and belief are believed to be true, and further, these statements are made with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under 18 U.S.C. § 1001, and that such willful false statements may jeopardize the validity of this application or any patent issued thereon.

01-31-2006

Date



Petar R. Dvornic

## **CURRICULUM VITAE**

**Name: Petar R. Dvornic**

**Rank: Professor**

**Date and Place of Birth: May 19, 1948; Belgrade, Yugoslavia**

**Present Address: Home: 2806 St. Mary's Drive, Midland, MI 48640**  
**Work: Michigan Molecular Institute,**  
**1910 West St. Andrews Road,**  
**Midland, MI 48640-2696**

### **Education**

**B.S. Department of Technology and Metallurgy, University of Belgrade, Belgrade, 1972.**

**M.S. Department of Technology and Metallurgy, University of Belgrade, Belgrade, 1975.**

**M.S. Department of Polymer Science and Engineering, University of Massachusetts, Amherst, 1978.**

**Ph.D. Department of Polymer Science and Engineering, University of Massachusetts, Amherst, 1979.**

### **Theses and Dissertation**

**"On the Kinetics of Suspension Polymerization of Methylmethacrylate", B.S. Thesis, Department of Technology and Metallurgy, University of Belgrade, Belgrade, 1972.**

**"Preparation of Polymers With Well Defined Molecular Structure by Anionic Polymerization Reactions", M.S. Thesis, Department of Technology and Metallurgy, University of Belgrade, Belgrade, 1975.**

**"Preparation and Evaluation of Exactly Alternating Silarylene-Siloxane Polymers", Ph.D. Dissertation, Department of Polymer Science and Engineering, University of Massachusetts, Amherst, 1979.**

### **Research Experience**

**Koninkrijk Shell Plastics Laboratorium Delft, Delft, Holland, Student Trainee, 1968 and 1969.**

**Institute of Chemistry, Technology and Metallurgy, Department of Macromolecular Chemistry, Belgrade, Yugoslavia, Research Assistant, 1973 -1975.**

**Department of Polymer Science and Engineering, University of Massachusetts, Amherst, Massachusetts, Research Fellow, 1975-1979.**

**University of Massachusetts, Department of Chemical Engineering, Amherst, Massachusetts, Postdoctoral Fellow, 1979-1981.**

**Institute of Chemistry, Technology and Metallurgy, Department of Polymeric Materials, Belgrade, Yugoslavia, Research Scientist, 1979-1982.**

**Institute of Chemistry, Technology and Metallurgy, Department of Polymeric Materials, Belgrade, Yugoslavia, Senior Research Scientist, 1982-1996.**

**University of Massachusetts, Department of Chemical Engineering, Amherst, Massachusetts, Senior Research Scientist, 1985-1986.**

**Institute of Chemistry, Technology and Metallurgy, Center of Chemistry, Department of Polymeric Materials, Belgrade, Yugoslavia, Department Head, 1986-1996.**

**University of Massachusetts, Department of Polymer Science and Engineering, Amherst, Massachusetts, Senior Research Scientist, 1988.**

**University of Belgrade, Department of Chemistry, Belgrade, Yugoslavia, Associate Professor, 1991-1996.**

**Michigan Molecular Institute, Midland, Michigan, Nanochemistry and Molecular Architecture Group, Senior Associate Scientist, 1993-1994.**

**Michigan Molecular Institute, Midland, Michigan, Nanochemistry and Molecular Architecture Group, Research Scientist, 1994-1999.**

**Michigan Molecular Institute, Midland, Michigan, Silicon Polymers Group Manager, 1996-2000.**

**Michigan Molecular Institute - U. S. Army Research Laboratory Dendrimer Polymers Center of Excellence, Midland, Michigan, Co-Principal Investigator, 1996-1998.**

**Michigan Molecular Institute, Midland, Michigan, Senior Research Scientist, 1999-present.**

**Michigan Molecular Institute, Midland, Michigan, Silicon and Dendritic Polymers Group Manager, 2000-present.**

#### **Scientific Titles**

**Research Scientist, (Equivalent to Docent), Institute of Chemistry, Technology and Metallurgy, Belgrade, Yugoslavia, 1982-1986.**

**Senior Research Scientist, (Equivalent to Associate Professor), Institute of Chemistry, Technology and Metallurgy, Belgrade, Yugoslavia, 1986-1991.**

**Science Consultant, (Equivalent to Full Professor), Institute of Chemistry, Technology and Metallurgy, Belgrade, Yugoslavia, 1991-present.**

**Senior Associate Scientist, Michigan Molecular Institute, Midland Michigan, 1993-1994.**

**Research Scientist, Michigan Molecular Institute, Midland, Michigan, 1994-1999.**

**Senior Research Scientist, Michigan Molecular Institute, Midland, Michigan, 1999-present.**

#### **Teaching Titles and Experience**

**Docent, Department of Technology, University of Novi Sad, Yugoslavia, 1981-1991.**

**Short Course: "Basic Properties and Ways of Preparation of Synthetic Polymeric Materials", a part of a fourth year course: "Selected Processes of Chemical Industry", Department of Chemistry, University of Belgrade, Belgrade, Yugoslavia, 1989-1991.**

**Associate Professor, Department of Chemistry, University of Belgrade, Belgrade, Yugoslavia, 1991-1994.**

**Course: "Synthetic Polymer Chemistry", a fourth year undergraduate level course (501), Department of Chemistry, University of Belgrade, Belgrade, Yugoslavia, 1991-1994.**

**Short Course: "Polymers Containing Silicon: Synthesis, Structure, Properties and Applications" (507), Center of Multidisciplinary Studies, University of Belgrade, Belgrade, Yugoslavia, 1992.**

**Associate Professor, Michigan Molecular Institute, Midland, Michigan, 1993-1997.**

**Course: "Polymer Synthesis", graduate level course (602), joint: Michigan Molecular Institute, Michigan Technological University and Central Michigan University, Midland, Michigan, 1994-present.**

Course: **"Silicone Chemistry and Technology"** (joint with D. Gravier and M. J. Owen) graduate level course (707), Michigan Molecular Institute, Midland, **1995-present.**

Course: **"Dendritic Polymers: Science and Technology"**, graduate level course (613), Michigan Molecular Institute, Midland, Michigan, **February 1997.**

**Adjunct Professor**, Department of Chemistry, Central Michigan University, Mount Pleasant, Michigan, **1996-present.**

**Adjunct Professor**, Michigan Technological University, Houghton, Michigan, **1996-present.**

**Professor**, Michigan Molecular Institute, Midland, Michigan, **1997-present.**

An International Workshop: **"Perspectives on Silicon"** (joint with: M. Brook, McMaster University; D. Graiver, Michigan State University; J. Matison, University of South Australia and M. J. Owen, Michigan Molecular Institute), Ian Wark Research Institute, University of South Australia, Adelaide, South Australia, **July 15-19, 2002.**

#### **Scientific and Professional Societies**

**American Chemical Society**, Division of Polymer Science, member: **1977-present**; Division of Polymer Materials and Engineering, member: **1995-present.**

**Society of Plastics Engineers**, member: **1977-1982.**

**Serbian Chemical Society**, member: **1980-present.** Division of Chemistry and Technology of Macromolecules: member: **1980-present**; president: **1988-1993.** Presidency of the Serbian Chemical Society, member: **1992-1993.**

**European Polymer Federation Committee**, member, **1991-1995.**

**Materials Research Society**, member, **1995-1999.**

**American Physical Society**, member, **1996-1998.**

#### **Scientific Meeting Committees**

**"IV Yugoslavian Symposium on Organic Chemistry"**, Belgrade, Yugoslavia, **1987**; member of the organizational committee, **1987.**

**"VI European Symposium on Organic Chemistry - ESOC VI"**, Belgrade, Yugoslavia, **1989**; member of the organizational committee: **1988-1989**; editor of "Daily Newsletter": **1989.**

**"X Yugoslavian Symposium on Chemistry and Technology of Macromolecules",** Vrnjacka Banja, Yugoslavia, 1989; member of the organizational committee: **1988-1989.**

**"XXXIV Annual Meeting of the Serbian Chemical Society",** Belgrade, Yugoslavia, 1992; member of the scientific committee: **1991-1992.**

**"XXXV Annual Meeting of the Serbian Chemical Society",** Belgrade, Yugoslavia, 1992; member of the scientific committee: **1992.**

**"Polyitaconates: materials with future",** Scientific Meeting of the Serbian Chemical Society, Belgrade, Yugoslavia, 1992; principal organizer and coordinator: **1992.**

**"Symposium on Structure Controlled Macromolecules",** Materials Research Society Spring Meeting 1996, San Francisco, California, Session Chairman, **April 1996.**

**"Dendrimers and Dendritic Polymers: From Science Fiction to Reality",** 54<sup>th</sup> ACS Fall Scientific Meeting, Midland, Michigan, Chairperson, **October 31, 1998.**

**"Silicones in Coatings III",** Paint Research Association, International Conference, Barcelona, Spain, member of the Scientific Advisory Committee, **March 28-30, 2000.**

**"Organic-Inorganic Hybrides",** Paint Research Association International Conference, University of Surrey, Guildford, UK, member of the Scientific Advisory Committee, **June 12-14, 2000.**

**"Organic-Inorganic Hybrides II",** Paint Research Association International Conference, University of Surrey, Guildford, UK, member of the Steering Committee, **May 28-29, 2002.**

**"Silicones in Coatings IV",** Paint Research Association, International Conference, University of Surrey, Guildford, UK, member of the Steering Committee, **May 30-31, 2002.**

**"Nanotechnology: Turning Small Science into Big Money"** 61<sup>st</sup> Fall Scientific Meeting of the ACS Midland Section, member of the Organizing Committee, Chair of the Symposium on Nano-Scaled Building Blocks and Nanostructures, **October 14, 2005.**

#### **Other Professional Activities**

**Scientific Board of the Institute of Chemistry, Technology and Metallurgy,** Belgrade, Yugoslavia, Member: **1981-1994;** President: **1982-1986.**

**"Polymers",** Yugoslav Journal of Plastics and Rubber, Zagreb, Yugoslavia, Member of the Editorial Board: **1983-1985.**



**Belgrade Science Foundation, Belgrade, Yugoslavia, Member of the General Assembly: 1982-1986 and 1986-1990; Member of the Elections and Awards Committee: 1982-1986; Vice-President of the Main Council: 1986-1988; President of the Main Council: 1988-1990.**

**Scientific Council of the Institute of Chemistry, Technology and Metallurgy, Belgrade, Yugoslavia, Member: 1984-1993, Vice-President: 1984-1988; President: 1988-1992.**

**University of Belgrade, Belgrade, Yugoslavia, Committee for Elections of Professors and Staff Members in Natural Sciences and Mathematics, Member: 1986-1988.**

**Foundation for Technological Development of the Republic of Serbia, Belgrade, Yugoslavia, Member of the Council: 1990-1993; Vice-President of the Council: 1990-1991; President of the Committee for New Materials: 1991-1992.**

**Association of the Science Institutes of Serbia, Belgrade, Yugoslavia, Member of the Coordination Committee: 1989-1993.**

**Serbian Science Foundation, Belgrade, Yugoslavia, Member of the Committee for International Cooperation: 1991.**

**Scientific-Teaching Council of the Department of Chemistry, University of Belgrade, Belgrade, Yugoslavia, Member: 1992-1994.**

**"Journal of the Serbian Chemical Society", Belgrade, Yugoslavia, Guest Editor for the issue dedicated to the memory of Professor Mihajlo S. Jacovic, 1992-1993.**

**"Silicon Chemistry", Kluwer Academic Publishers, The Netherlands, Member of the Editorial Board and Subject Editor for Dendrimers and Dendritic Polymers: 2001-present.**

**Dendritech Inc., Board of Directors: Director, 2001-present.**

**American Chemical Society, Midland Section, Midland, MI, Awards Committee: Chair, 2003-2005, Member 2003-present; Board of Directors: Director, 2004-present.**

**MATRIX Midland Festival. Board of Managers: Manager, 2004-present.**

#### **Awards**

**Belgrade Scientific Foundation Award, Award for Contribution to the Operations of the Foundation 1982-1986, Belgrade, Yugoslavia, 1986.**

**Serbian Chemical Society Award, Award for Contribution to the Operations of the Society, Belgrade, Yugoslavia, 1990.**

**Belgrade Scientific Foundation Award**, Award for Contribution to the Development of Science, Belgrade, Yugoslavia, 1990.

**Serbian Chemical Society, Deserving Member Award**, Belgrade, Yugoslavia, 1992.

**The Midland Chapter of Sigma Xi**, Annual Best Paper Award for "Rheology of Dendrimers. I. Newtonian Flow of Medium and Highly Concentrated Solutions of Polyamidoamine (PAMAM) Dendrimers in Ethylenediamine (EDA) Solvent", published in *Macromolecules*, 1998, 31, 4498-4510, 1999.

#### **Areas of Research Interest**

**Synthesis of new monomers and polymers.** Step-growth polymerization reactions. Thermally stable polymers. Polysiloxanes and other silicon containing polymers. Aromatic polyamides, polyhydrazides, poly(amide-hydrazides) and related polymers. Rheologically rigid, semi-rigid and liquid-crystalline polymers. Liotropic liquid crystallinity. Flexible polymers and elastomers. Thermally stable elastomers. Liquid-crystalline elastomers.

**Structure-property relationships in polymers.** Thermal and rheological properties of polymers. Semipermeable polymer membranes. Permeability and permselectivity. Critical polymer molecular dimensions. Applications of polymers under extreme temperatures; as ultra high modulus fibers; for reverse-osmosis and ultra filtration membranes; as elastomers, particularly high temperature elastomers; as liquid crystalline materials; in medicine, pharmacology and dentistry.

**Unusual macromolecular architectures.** Dendrimers, hyperbranched and other dendritic polymers: synthesis, characterization and applications. Rheological and thermal behavior of dendritic polymers. Dendritic polymer networks. Effects of macromolecular architecture on materials properties and structure-property relationships. Macromolecular isomerism. Nanoscopic chemistry.

**Dendritic polymers-based nanotechnology.** Silicon-containing dendritic polymers. Copolymeric dendrimers and hyperbranched polymers. Organic - inorganic nanocomposites, molecular hybrids. Dendrimer-based nanocomposites. Applications of dendritic polymers nanotechnology in electronics, opto-electronics, nano-lithography, chemical and biological sensors, interlayer dielectrics, nano-domained networks and coatings, aquatic anti-fouling protection.